



beetles

Science and Teaching for Field Instructors

Student Activity Guide

Bird Language Exploration

By paying attention to the sounds and behaviors of birds, students are introduced to a whole new way to experience and observe what's happening in their surroundings, both during their field experience and back home. In this Focused Exploration activity, students pay attention to the birds around them. After listening as a group, students imitate calls and notice differences between them. Students think about and discuss the different messages birds might communicate, then they individually watch and listen to birds from a Sit Spot. When the group gathers again, students compare their observations and make a large map of the bird vocalizations and behaviors they observed.

Students will...

- Increase their awareness of birds, their vocalizations and behaviors.
- Build an understanding of how and why birds communicate.

Grade Level:

Grades 3-8. Adaptable for younger or older students.



Timing:

about 45 minutes (all together) or do two shorter chunks

Related Activities:

I Notice, I Wonder, It Reminds Me Of
Interview an Organism
Tracking



Materials:

1 portable white board & a white board marker, 1 large sheet of paper & markers for paper

Optional: Binoculars for students

Tips:

To ensure a successful experience, review the teaching tips found on page 2 and throughout this guide.



Setting:

Choose an area with a wide range of visibility and a diversity of birds that are likely to be voicing at the time of day you're visiting. 5-8 species is ideal.

NEXT GENERATION SCIENCE STANDARDS

FEATURED PRACTICE

Constructing Explanations

FEATURED CROSSCUTTING CONCEPT

Patterns

DISCIPLINARY CORE IDEAS

Growth & Development of Organisms
Social Interactions & Group Behavior

For additional information about NGSS, go to page 10 of this guide.



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Bird Language Exploration

ACTIVITY OVERVIEW

Bird Language Exploration	Learning Cycle Stages	Estimated Time
Listening to Birds as a Group	Invitation Exploration	10 mins.
Deciphering the Noise	Concept Invention	15 mins.
Bird Sit	Application	5-15 mins.
Discussion of Observations	Concept Invention Application	10 mins.
Wrapping Up	Reflection	5 mins
TOTAL		45+ minutes

Field Card. On page 14 of this guide is a pocket-sized version of this lesson that you can use in the field.

Read the Instructor Support Section. Beginning on page page 8, you'll find more information about pedagogy, student misconceptions, science background, and standards.

TEACHING TIPS

Scout your site beforehand! Of course you can't control the birds, but in ideal conditions you'd have 5-8 species of birds calling, a wide range of visibility, and few distractions. A hillside or marshland with an open view is better than under the canopy of a forest. The edge between two plant communities is often a good place to hear and see a lot of birds, e.g. where a forest meets a meadow. In choosing your site, remember that the amount of bird chatter will change depending on the time of day and the presence of perceived danger on the part of the birds. Prepare your students to move quietly and select an area where other groups are unlikely to disturb the peace. If disturbances do happen, take the opportunity to observe the birds' responses.

Birds vocalize year-round. Even though mating songs are typically only sung by birds in the spring, birds are responding to their environment through behaviors and vocalizations year-round.

TEACHING NOTES

Finger Listen. This routine was inspired by Joseph Cornell's activity, *Sounds*, from *Sharing Nature With Children*. It's a great way to get students to quietly focus in on the moment and location from a different perspective.

See the BEETLES website for additional information on the routines, *Turn & Talk*, and *I Notice, I Wonder, It Reminds Me Of*.

Finding your flock. In another fun and rowdy bird language activity, you tell students to quietly listen to and memorize a bird call. Then, when you give the word, they each start making their call, and attempt to find others who are imitating the same call. Then each group shares their bird call with the whole group.

Disturbing the birds. The bird call symphony is fun and a good ice-breaker, but the outburst of noise may disturb nearby birds. Consider this possibility when you decide when and where to stage your symphony—you might have to move afterwards if the birds leave. You might choose to do it at the end of the activity.

Engaging shy students. Some students may be shy or reluctant to share birdsong imitations. Starting with the "symphony" can help break the ice, and instead of pointing at individuals, you can ask students to step forward and take a "bird song solo" if they choose to.

Listening to Birds as a Group

1. **Ask students to circle up and tell them to do a silent "Finger Listen."** Gather the group and have everyone *silently* focus on listening to the sounds around them, and holding up a finger for each new sound they hear. Tell students to listen especially for sounds they think are coming from birds. Say:

 ▶ *Each time you hear a new sound, put one finger up. It's fun to look around the circle and make eye contact when someone else lifts a finger at the same moment because of the same sound.*
2. **Let students know they'll be learning about the language of birds, which will help them to know more about what's going on around them in nature.** Explain that birds are constantly communicating, and by paying close attention you can start to learn not only what they are communicating, but how their behavior can give you information about other things going on in the area.
3. **Ask students to Turn & Talk and discuss the bird calls they heard.** In pairs, ask students to make statements beginning with the words "I noticed," "I wonder," "It reminds me of," focused on the bird calls they heard. After a few minutes, have some students share out observations or questions about the bird calls, or what any of the bird calls reminded them of.
4. **Ask students to listen silently again to memorize one bird call.** Have everyone focus on listening to bird calls again, but this time ask each student to focus on carefully memorizing one bird call, so they can imitate it in a minute. Tell students it can help to "draw" the bird call in the air by sticking out one finger and moving it up and down when the bird call moves up and down in pitch.

Deciphering the Noise

1. **Ask students to share their bird call imitations.** You can ask students to share their imitations quietly with a partner, or you can have them each take turns sharing with the group when you point at them. Or, you can arrange a bird call symphony (see next step).
2. **[optional] Create a bird call symphony, in which students all share bird calls at the same time, with occasional solos.** Tell students to remember their bird call, and that together you will make a "bird call symphony." You will be the conductor and the students will be the birds. When you make a certain hand signal, all students make the bird calls they just memorized. All the voices will be layered on top of each other in a big cacophony! When you make another signal with your hands, they go silent. When you point to an individual, just that person makes their call.
3. **Ask students to describe similarities and differences between the bird calls they observed.** Ask a few students to share ways the bird calls they observed were similar to or different from one another.



4. Explain that scientists look for patterns like the similarities between bird calls, and then think about how or why those patterns might occur.

Explain that observing patterns and asking and investigating questions about them helps scientists learn about the world.

5. Tell students people have identified patterns in calls made by different types of birds, which can help us learn about bird behavior. Explain that even though there are many kinds of birds, people have identified patterns in bird calls because birds have similar responses to certain situations in order to have the best chance of survival.

6. Turn & Talk: What kinds of messages might birds need to communicate, and how might they help with survival? Ask students to discuss in pairs what kinds of messages they think birds are communicating through their calls, why those messages would be important for the birds' survival, and what those calls might sound like.

7. Students share out ideas as you record them on white board. Ask students to share out kinds of messages birds might need to communicate, and how might they help with survival. As students come up with ideas, write down summary words for them on a white board, such as "territory" or "begging." Add any of the following that students don't bring up:

- Let others know the boundaries of a territory (Territory)
- Chasing another away (Aggression)
- Identify flock or family members (Contact)
- Ask parents for food (Begging)
- Announce the presence of a predator (Alarm)
- Attract a mate (Attract)
- Let others know where food is (Food call)

8. Share brief information/examples about each "category" of call. Describe or demonstrate examples of each type of communication, but keep these descriptions brief. For example:

- Songs are often used to alert others about territory, and also for attracting a mate.
- Aggression calls and alarm calls are often loud and abrupt sounding.
- Short call notes are often used to stay in contact with others from a family or species.
- Young birds make begging calls, which are often incessant and high-pitched, to ask for food.

9. Explain how bird calls are behaviors that take energy and give away location, which can be dangerous. Explain that birds don't call just for the heck of it. It takes energy for a bird to make calls, and it reveals their location, which can be dangerous.

TEACHING NOTES

Bird vocalizations and behaviors. For more details on the bird vocalizations and behaviors that correspond to each type of communication, read the instructor support section.

What Geronimo knew. People have been observing and interpreting bird language for centuries, and probably much longer. Apache leader Geronimo is said to have used bird language to pinpoint the locations of enemy troops long before he could hear or see them. When you tune in to what the birds are saying, you deepen your awareness of everything else in the environment.

TEACHING NOTES

Journaling opportunity. Consider sending students to their sit spots with journals and pencils, and asking them to record written observations and diagrams showing patterns of bird movement, behavior, or vocalizations—students will remember more of what they observe if they record it in their journals.

Teaching in two “chunks.” If you think your students would do better to move their bodies before Bird Sit, hike them to another area, then do the activity. If you did a bird symphony and think it has disturbed the birds in the area too much, that’s another good reason to move on another spot for Bird Sit

Making a map during bird sit. While students are doing their bird sit, you may want to make (or have a chaperone make) a basic map of the bird sit area’s environmental features, such as bodies of water and thickets of vegetation. This way, you can focus on adding bird behavior to the map while students share, and students won’t have to sit and watch as you draw the map.

10. Ask students what might make it worth it for birds to expend energy making calls, then explain that their communications increase chances of surviving and reproducing.
11. **Facilitate a short discussion about alarm calls (how birds respond to danger).** Tell students you’re going to focus on alarm calls and other ways birds respond to different kinds of threats, because alarm calls can help them learn a lot about what’s going on around them. Facilitate a short discussion with the following statements/questions (but move on BEFORE students become disinterested):
 - ▶ *If you’re listening to birds, some sounds will be alarm calls, responding to danger. They sound more urgent than other kinds of calls.*
 - ▶ *What are some animals birds might be concerned about? [hawks, ground predators, people, etc.]*
 - ▶ *Birds respond to different threats in different ways: sometimes they move away, sometimes they sit still, sometimes they make alarm calls, sometimes they go quiet.*
 - ▶ *Act out or illustrate (on a whiteboard) the following examples:*
 - ▶ *If a bird was perched in the top of a tree and a hawk flew nearby, what might it do? [go silent, fly to the ground]*
 - ▶ *If a bird was on the ground and a bobcat came near, what might it do? [fly to top of tree, start making an alarm call]*
 - ▶ *If a noisy hiking group walked through an area, what might birds do? [for this one, just listen to ideas students have]*

Bird Sit

1. **Tell students they will sit in one spot to silently listen, watch, and try to remember bird behavior around them.** Explain to students that they are going to spend a few minutes observing birds on their own and beginning to interpret what they see and hear. Remind students of the list they brainstormed of what messages birds might be communicating. Encourage students to try to distinguish between these messages as they observe, and to think about what might be happening in the environment to cause birds to respond with those calls or behaviors.
2. **Emphasize looking for patterns.** Tell students to pay particular attention to any patterns they notice. You may prompt them with questions such as: Is a bird making the same call again and again? When it makes that call, is it in response to something similar happening in the environment or something different? Are different species of birds making similar calls? When do they make those calls? Do you think they are using them to communicate similar things or different things?
3. **Explain boundaries and expectations for the bird sit (silent, alone, sitting up).** Tell students they are to sit silently and alone, far enough away from others that they won’t distract each other. Set some natural boundaries so the whole group can observe the same general area. It is best for students to sit up (not lie down) so they can see the widest range of activity.

4. **Demonstrate the signal you will use to let the group know when the bird sit is over.** This could be a bird call you know, a visual cue, or whatever signal you commonly use to get students' attention.
5. **Set students loose to sit silently for 5-15 minutes, to listen to and watch birds.** Dismiss students to sit in their spots, but remind them to find spots quietly and slowly (if you have a small group, sending them one at a time can be a way to make sure students don't rush and disturb birds). Be aware of student engagement. If students are listening intently, give them more time; if they are getting distracted, give them less time.

Discussion of Observations

1. **Ask students to Turn & Talk and compare observations and patterns from their bird sit.** When it's time, signal students to end the bird sit, and ask them to pair up with someone nearby to compare what they noticed. Encourage them to discuss any patterns they noticed.
2. **Make a large map of observations of bird behavior (not explanations yet).** Gather the group together and ask them to share some of their observations. Use a large white board or piece of paper to make a visual map as students share observations. If students make explanations instead of sharing observations (e.g. a bird called to defend its territory), gently point this out, and ask for observations. Ask for corroboration from students who had different perspectives on an event, e.g. "What did you notice from where you were sitting, Andres? Did you also see the bird dive into the bush?" Include environmental features on the map, such as bodies of water, thickets of vegetation, etc. [See example map on the next page].
3. **Ask students to Turn & Talk about possible explanations for what could have caused one of the bird calls or behaviors they observed.**
4. **Students share and discuss a few of their ideas in the large group, including evidence.** Ask students to share out explanations, including the evidence behind their explanations. For example, if a student thought a certain call was to defend territory, did they notice any other nearby birds that could have caused the bird to respond in that way? Was there a pattern of the bird making that call each time another bird approached? See if other pairs had different ideas. After a few pairs share their ideas (but before students lose interest in the topic), move on.

Wrapping Up

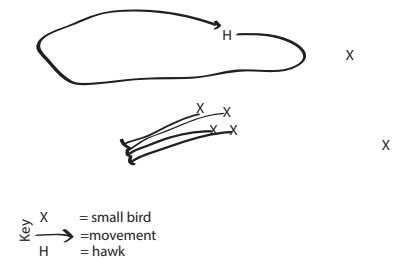
1. **Explain to students that this process is a way to notice and interpret bird behavior around you, anywhere.** Point out that students have just learned a new way to observe birds anywhere, including in neighborhoods back home. It's a way to "read" or interpret bird calls, and learn a lot about what is going on around them. Tell students that if they keep observing bird language, they can notice a lot that others miss out on. Ask students where else they might try observing bird language.

TEACHING NOTES

City birds. "Sometimes people in cities feel like they don't have a way to learn this, but I learned bird language for the first time in a somewhat small city park that had some trees and bushes. Cats, dogs, and joggers served as the 'predators' that birds responded to."

-Mark Kudrav (aka Redstart), 2014 Green Birding Record Champion

Example map of observations of bird behavior:



Identifying birds with field guides. If you have student-friendly field guides for identifying birds, you might make them available to students at the end of this activity to help them try to identify birds they have been observing.

TEACHING NOTES

2. **Point out that noticing patterns in nature can be a way to learn more about what's going on in the natural world.** Encourage students to keep looking for patterns everywhere because they can learn about how the world works by noticing patterns, observing them more closely, and thinking about why they might occur.
3. **Have students *Turn & Talk* or *Walk & Talk* to discuss the questions below.** Ask students to pair up with someone new to discuss some of the following questions.
 - ▶ *What did you learn about bird behavior?*
 - ▶ *What patterns did you notice as you observed and interpreted bird language?*
 - ▶ *Do you think you could "learn the language" of a different animal? How? What might be challenging about doing that?*
 - ▶ *What's something that surprised you today?*
 - ▶ *What helped you learn today?*
4. **Focus on bird behavior throughout field experience.** Be sure to provide other opportunities for students to focus on bird calls throughout the rest of your field experience. As opportunities arise, ask students to notice patterns in calls or behaviors and what they think might cause them.

TEACHING NOTES

"Names are useful and important, but there's some sort of switch that can go off in our head once we have figured out the name for a species we are observing. That's why when teaching, instead of leading with the name, I 'trail' with it."

–John Muir Laws, naturalist/artist and instructor.

"Making lists of animals is 'Glance & Go' nature watching. It might be a fun sport, but it's not natural history."

–Todd Newberry, professor emeritus at University of California Berkeley and author of *The Ardent Birder*.

Instructor Support

Teaching Knowledge

It's fun to identify organisms. "Birding," or "birdwatching," in which people look and listen to identify birds in the wild, is a hugely popular wildlife observation activity. Many birders enjoy adding to their life list of birds identified in the wild, and getting students "hooked" on this activity can be a pathway to an on-going outdoor pursuit for them. But sometimes birders can become so focused on identifying birds that they neglect observing them beyond identification purposes. *Bird Language Exploration* focuses students on observing and interpreting bird behavior. Learning names of organisms is useful, but when and how organism names are shared with learners can significantly impact observations and learning. To encourage student engagement with and getting to know an organism through observations, questions, connections, and explanations, it's generally (but not always) best to hold off on providing a name until after students have made their own observations of the organism. It's also useful to have students look up organisms using simple accessible keys, to empower them to learn how to identify organisms for themselves. That's why we suggest providing field guides for students to identify birds after they have spent time observing them.

Conceptual Knowledge

Studying bird language is fascinating! With a little bit of prior knowledge and a lot of practice, you can begin to interpret what most people hear as a bunch of unintelligible chatter. Understanding bird language gives you insight into a lot of the other animals in an ecosystem as well.

With over 10,000 species of birds worldwide, it's hard to become an expert in bird communication. Fortunately, a growing number of scientists have published studies on bird vocalization and behavior. As it turns out, most vocalization and communicative behaviors fall into just a few categories.

Motivations for Communication

- Attract a mate
- Identify flock or family members
- Ask parents for food
- Convey information on where food is
- Chase another away
- Express the boundaries of a territory
- Announce the presence of a predator

How do birds communicate these needs? Birds communicate through both vocalizations and behaviors. Vocalizations are diverse. Nearly all 10,000 species have their own songs. Many have a large array of other calls as well. As a basis for beginners, most vocalizations can be put into the following categories.

Types of Vocalization

1) Song. Nearly every species of bird has its own distinct song, making it possible for birders to identify a species without seeing it. Often a bird's song is one of the louder sounds it can make and very often, especially in the spring, it is repetitive. Generally, bird songs occur more in the spring because the male is singing to attract a mate. Females may choose a male based on the quality of the song, the male's persistence in singing, or its large repertoire (many variations of song). Song is also used to deter other birds from entering a territory. By singing, a bird may be saying, "I am here. This area and all of its insects, berries, protective cover, females, etc. are mine." In this way, birds use song to say, "No Trespassing." Some songs are non-vocal, like the drumming of woodpeckers on trees or the thumping of the wings of a grouse.

2) Contact Calls. Identify flock or family members. Birds have a number of reasons to give short call notes. Staying in touch is one of those reasons. Many birds, such as the California towhee, call back and forth (male and female), keeping tabs on each other in thick vegetation. Others, like the acorn woodpecker, live in family groups, and many family members can be heard chattering at once. The familiar honking of geese as they fly is their way of keeping the flock together and, perhaps, motivated.

3) Begging. Young birds may beg for food from the time they hatch until they are completely gone from their parents' lives. Begging even happens outside of the nest as the birds grow and start to take more risks. Often the begging cries are an incessant and high pitched sound. Begging calls are mostly heard in spring and early summer. Occasionally, adult birds beg for food during courtship.

4) Aggression. Birds may become aggressive with each other if their territory is threatened. This vocalization occurs primarily between males of the same species. Aggression calls are loud, abrupt sounding, and may lead to a chase.

5) Alarm. Alarm calls are used when birds feel threatened by something. Some reasons for alarm calls are obvious, and others less so. For example, a bird might alarm to warn its mate or young of a threat. But it might also alarm to try to deter the predator. If the predator realizes it has lost its surprise advantage, it may give up the hunt. A third reason for alarm calls may be to alert other birds, even of different species, to the presence of a predator. This alert invites other birds to help gang up on the predator and "mob" it. You can see this behavior when several small birds dive-bomb a hawk.

Alarm calls vary depending on the level of threat. A robin that is bothered by a person walking and talking loudly on the ground 30 feet below may give one type of alarm call. The same robin would give a different alarm call if it was being chased by a Cooper's Hawk. In other words, the alarm can range from mild to urgent.

Aggression calls can sound very similar to alarm calls. Some birds even use the same sound for both. But alarm calls are different from aggression calls in the way other birds respond to them. If, for instance, a male robin is being territorial and aggressive to another male robin, other species of birds will show no reaction. If that same robin sounds an alarm due to a hawk, the other birds

TEACHING NOTES

TEACHING NOTES

About the Next Generation Science Standards (NGSS). The development of the Next Generation Science Standards followed closely on the movement to adopt nationwide English language arts and mathematics Common Core standards. In the case of the science standards, the National Research Council (NRC) first wrote a Framework for K-12 Science Education that beautifully describes an updated and comprehensive vision for proficiency in science across our nation. The Framework—validated by science researchers, educators and cognitive scientists—was then the basis for the development of the NGSS. As our understanding of how children learn has grown dramatically since the last science standards were published, the NGSS has pushed the science education community further towards engaging students in the practices used by scientists and engineers, and using the “big ideas” of science to actively learn about the natural world. Research shows that teaching science as a process of inquiry and explanation helps students to form a deeper understanding of science concepts and better recognize how science applies to everyday life. In order to emphasize these important aspects of science, the NGSS are organized into three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts and Disciplinary Core Ideas (DCI’s). The DCI’s are divided into four disciplines: Life Science (LS), Physical Science (PS), Earth and Space Science (ESS) and Engineering, Technology and Applied Science (ETS).

Read more About the Next Generation Science Standards at <http://www.nextgenscience.org/> and <http://ngss.nsta.org/>

will take notice.

Non-Vocal Behaviors

Birds can also communicate without making any noise. Here are a few examples of communicative behaviors, some complex, others simple.

- 1) Tail flicking.** Some species flick their tails in the direction of a threat or predator.
- 2) Bill rubbing.** Sometimes birds rub their bills just to clean them. Other times they do it to display agitation.
- 3) Mobbing.** Some birds will attack or harass predators that might otherwise attack them (i.e. a raven chasing a hawk, or a jay dive-bombing a cat). The idea is that the predator will get frustrated or bothered by the mobbing and leave the area.
- 4) Sitting sentinel.** Birds will often perch at the very tops of trees. There are many reasons for this behavior, but here are a few possible interpretations:
 - The bird is perched high so that when it sings, the song can be heard from far away.
 - The bird flew from the ground to get away from a ground predator.
 - The bird was pulled up out of curiosity. Perhaps it heard something moving in the nearby vegetation, or heard the alarm calls of a different bird. Its new position gives it a better vantage point to see the source of the alarm.
- 5) Flying away.** Keep in mind that birds are not always flying away from things that scare them. Also, birds may not fly far away from all predators. For example, a bird fleeing from a bobcat or coyote doesn’t have to fly far to be safe. It only needs to fly out of reach of a ground predator. When birds fly away, pay attention to what they’re flying away from *and* what they’re flying toward—dense cover, a body of water, etc.

Additional Resources

[What the Robin Knows](#) by Jon Young

www.birdlanguage.com

www.birds.cornell.edu/AllAboutBirds/studying/birdsongs

Big thanks to Mark Kudrav, birder and naturalist of San Mateo Outdoor Education, for his guidance in developing this activity and the instructor support section.

Connections to Next Generation Science Standards (NGSS)

BEETLES student activities are designed to incorporate the “three-dimensional” learning that is called for in the Next Generation Science Standards (NGSS). Three dimensional learning weaves together Science Practices (what scientists do), Crosscutting Concepts (thinking tools scientists use), and Disciplinary Core Ideas (what scientists know). Students should be exploring and investigating rich phenomena, and figuring out how the natural

world works. The abilities involved in using Science Practices and Crosscutting Concepts—looking at nature and figuring things out, using certain lenses to guide thinking, and understanding ecosystems more deeply—are mindsets and tools students can take with them and apply anywhere to deepen their understanding of nature. And, they’re interesting and fun to do!

In *Bird Language Exploration*, students engage in the science practice of Constructing Explanations to build a foundation for understanding disciplinary core ideas related to Growth and Development of Organisms and Social Interactions and Group Behavior, and to relate those ideas to the crosscutting concept, Patterns.

Featured Science and Engineering Practices

Engaging students in Constructing Explanations. According to the Framework for K-12 Science Education, a major goal of science is to deepen human understanding of the world through making explanations about it, and that students should develop their understanding of science concepts through making their own explanations about natural phenomena.

- In *Bird Language Exploration*, students initially engage in this practice when they talk about how the messages birds might try to communicate would be critical to a birds’ survival.
- Students also engage in this practice after the “bird sit” when they make tentative explanations about what environmental factors might have led to specific bird behaviors and bird calls that they observed. For example, a student who says, “I think the birds making short calls were doing alarm calls because a hawk flew by right before that,” has constructed a possible explanation for why a group of birds behaved a certain way.

In order for students to be fully engaged in this practice they need to go beyond just saying an explanation. They also need to consciously use tentative language (“I think that...”), base their explanations on evidence, and consider alternate explanations based on that evidence. *Bird Language Exploration* does not provide the opportunity to engage in the practice to this extent.

To continue to deepen students’ experience in constructing explanations, use other BEETLES activities that delve deeper into the practice, such as *Tracking, Structures & Behaviors*, or *Case of the Disappearing Log*.

Featured Crosscutting Concepts

Learning science through the lens of Patterns. According to the *Framework for K-12 Science Education*, one way scientists use patterns is to categorize or classify parts of the natural world based on similarities and differences.

- In *Bird Language Exploration*, students learn to classify types of bird calls and behaviors that are common across species based on patterns that recur among those calls and behaviors.
- They also look for patterns in calls and behaviors as they do their bird sit.

TEACHING NOTES

Importance of teaching science practices. “Engaging in the practices of science helps students understand how scientific knowledge develops...It can also pique students’ curiosity, capture their interest, and motivate their continued study...” -National Research Council, A Framework for K-12 Science Education. Focus on these science practices will help to ensure a more scientifically literate public who will be better able to make thoughtful decisions.

About Crosscutting Concepts in the NGSS. Crosscutting concepts are considered powerful thinking tools for how scientists make sense of the natural world. The seven “big ideas” listed as crosscutting concepts are: Patterns; Cause & Effect; Scale, Proportion & Quantity; Systems and System Models; Energy & Matter: Flows, Cycles and Conservation; Structure & Function; and Stability & Change. These concepts may sound familiar, as they are quite similar to the themes referred to in science literacy documents as being important ideas that unify all disciplines of science and engineering.

TEACHING NOTES

Translating the codes used in the NGSS. Each standard in the NGSS is organized as a collection of performance expectations (PE) for a particular science topic. Each PE has a specific code, provided here so that they can be easily referenced in the NGSS documents. The first number or initial refers to the grade level: K - kindergarten, 1 - first, 2 - second, etc...MS - middle school, and HS - high school. The next letters in the code refer to the science discipline for the standard: LS, PS, ESS, ETS. The number following the discipline denotes the specific core idea within the discipline that is addressed by the PE, and the last digit identifies the number of the PE itself.

So, 3-LS4-4 means it's part of a third grade standard (3) for life science (LS), addressing the fourth core idea (4), Biological Evolution: Unity and Diversity, within the life science standards, that deals with Biodiversity and Humans. It's also the fourth performance expectation (4) that makes up the complete LS4 standard at this grade level.

- Then, students use knowledge about these patterns to make explanations about the situations that might lead birds to make certain kinds of calls.

Students are introduced to the idea that there are common characteristics among different species' bird calls early on in the activity. But don't skip over the step of highlighting the concept of patterns later, and explaining to students that noticing patterns is a useful thinking tool for looking at and learning about the natural world. Otherwise, students might not recognize it as a useful lens for other contexts. Make sure to emphasize this and, if possible, to ask students to look for patterns in some other context during their field experience so they get the opportunity to continue to engage with that way of thinking.

Featured Disciplinary Core Ideas

Students need multiple learning experiences to build their understanding of Disciplinary Core Ideas. *Bird Language Exploration* provides students with an opportunity to build some understanding of disciplinary core ideas relating to LS1.B Growth and Development of Organisms and LS2.D Social Interactions and Group Behavior.

- When students brainstorm possible reasons for birds' vocalizations and discuss how those behaviors might aid in the organisms' survival, they consider how alarm calls warn other individuals nearby, how mating calls increase the chances of reproduction, and of how partner calling aids in keeping familial groups together, which leads them to build some understanding of the DCI that animals engage in characteristic behaviors that increase the odds of reproduction (LS1.B).
- Through observing and discussing the ways that birds communicate and rely on each other to obtain food and defend the group from predators, students also build understanding of the idea that organisms engage in group behaviors that benefit individuals (LS2.D).

As an instructor, you can informally assess students' understanding of these concepts during different stages of the activity in individual interactions, and during group discussions. This information can help determine which DCI's to focus on in the future, and which follow-up activities or discussions could be used to further student understanding of these concepts.

Performance Expectations to Work Towards

No single activity can adequately prepare students for an NGSS performance expectation. Performance expectations are designed as examples of things students should be able to do to demonstrate their understanding of content and big ideas in science after engaging in multiple learning experiences and instruction over a long period of time. They are not the "curriculum" to be taught to students. Below are some of the performance expectations that this activity can help students work towards.

3-LS2-1. Construct an argument that some animals form groups that help members survive.

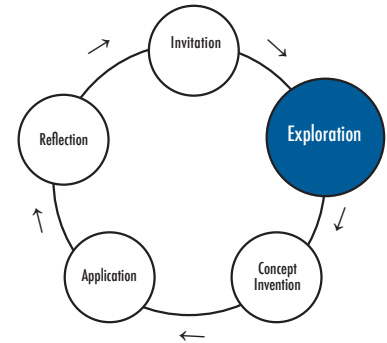
MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and

specialized plant structures affect the probability of successful reproduction of animals and plants, respectively.

Activity Connections

For other activities that emphasize Patterns, try *Lichen Exploration* or *I Notice, I Wonder, It Reminds Me Of*. To continue to build students' skills in the practice of constructing explanations, try *Structures & Behaviors*, *Case of the Disappearing Log*, or *Tracking*.

TEACHING NOTES



Learning Cycle Stage. As a separate activity, *Bird Language Exploration* completes a full learning cycle. Within a sequence of other activities focused on developing student understanding of adaptations, this activity could serve as Exploration.

FIELD CARD

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Bird Language Exploration

Listening to Birds as a Group

1. Circle up and do a "Finger Listen".
2. Explain: you'll be learning about bird language, which will help to know more about what's going on in nature.
3. Turn & Talk about bird calls they heard.
4. Listen again—each student memorizes one call.

Deciphering the Noise

1. Students share bird call imitations.
2. [optional] Bird call symphony.
3. Students share bird call similarities & differences.
4. Explain: looking for patterns is a tool scientists use to learn about the world.
5. Explain: people have identified patterns in bird calls to help understand bird behavior.
6. Turn & Talk: What kinds of messages might birds need to communicate & how might they help with survival?
7. Students share out ideas as you write them on white board. Include: Territory, Aggression, Contact, Begging, Alarm, Attract, Food call.
8. Briefly describe each category of bird call. Eg:
 - Songs alert about territory, & attract mates.
 - Aggression & alarm calls are loud & abrupt.
 - Short call notes are for contact with family or species.
 - Young birds beg: incessant high-pitched.
9. Explain: bird calls take energy & give away location, which can be dangerous.
10. Ask: what might make it worth it to expend energy making calls. Explain that communications increase chances of surviving & reproducing.
11. Discussion: alarm calls (how birds respond to danger) .

▶ If you're listening to birds, some sounds will be alarm calls, responding to danger. They sound more urgent than other kinds of calls.

▶ What are some animals birds might be concerned about? [hawks, ground predators, people, etc.]

▶ Birds respond to different threats in different ways: sometimes they move away, sometimes they sit still, sometimes they make alarm calls, sometimes they go quiet.

▶ Act out or illustrate (on a whiteboard) the following examples:

▶ If a bird was perched in the top of a tree and a hawk flew nearby, what might it do? [go silent, fly to the ground]

▶ If a bird was on the ground and a bobcat came near, what might it do? [fly to top of tree, start making an alarm call]

▶ If a noisy hiking group walked through an area, what might birds do? [for this one, just listen to ideas students have]

Bird Sit

1. Bird sit instructions: Sit in one spot to silently listen, watch, & try to remember the bird behavior around you.
2. Emphasize looking for patterns: Is a bird making the same call again & again? When it makes that call, is it in response to something similar happening in the environment or something different? Are different species of birds making similar calls? When do they make those calls? Do you think they are using them to communicate similar things or different things?
3. Explain boundaries & expectations for the bird sit (silent, alone, sitting up).
4. Show signal you'll use to cue the end.
5. Students Bird Sit for 5-15 minutes.

Discussion of Observations

1. Turn & Talk: compare Bird Sit observations.
2. Make large map of observations of bird behavior (no explanations yet).
3. Turn & Talk: possible explanations for what caused bird calls & behaviors.

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Wrapping Up

1. Explain: This is a new way to notice & interpret bird behavior around you anywhere.
2. Explain: Noticing patterns can help you learn about the natural world.
3. Turn & Talk or Walk & Talk:
 - ▶ What did you learn about bird behavior?
 - ▶ What patterns did you notice as you observed and interpreted bird language?
 - ▶ Do you think you could "learn the language" of a different animal? How? What challenges do you think you might encounter?
 - ▶ What's something that surprised you today?
 - ▶ What helped you learn today?
4. Focus on bird behavior throughout the field experience.



ABOUT BEETLES™

BEETLES™ (Better Environmental Education Teaching, Learning, and Expertise Sharing) is a program of The Lawrence Hall of Science at the University of California, Berkeley, that provides professional learning sessions, student activities, and supporting resources for outdoor science program leaders and their staff. The goal is to infuse outdoor science programs everywhere with research-based approaches and tools to science teaching and learning that help them continually improve their programs.

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